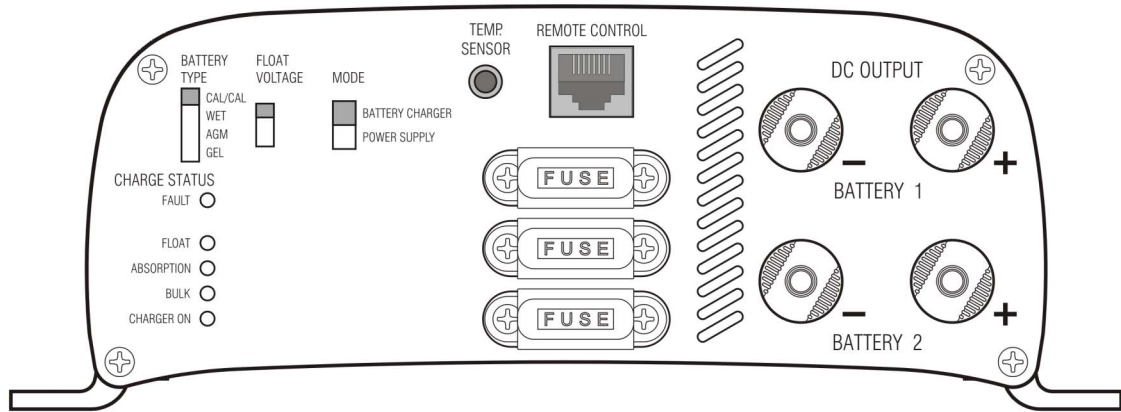




## FUM-2410CBP / FUM-2415CBP / FUM-2420CBP

### 3 stage battery charger

### User's manual



Keep this manual in a safe place for quick reference at all times.

This manual contains important safety and operation instructions for correct use of the battery charger. Read through the manual and pay special attention to the markings and labels of the charger, battery and equipment connected to the battery system.

Pay special attention to these two types of notices used in this manual.

#### WARNING

**Failure to heed this warning may cause injury to persons and damage to equipment.**

#### CAUTION

**Failure to observe this warning may result in damage to equipment and improper functioning of the charger.**

#### WARNING

- The charger is designed for in-door use. Protect the charger from ingress of water.
- This charger is made to charge only properly sized lead acid batteries.
- Charging other types of battery or under-sized lead acid batteries may cause fire or explosion.
- Install the charger in accordance with all local codes.
- Do not use the charger if it has been dropped or damaged.
- Do not remove casing of the charger, there is no user-serviceable parts inside.
- Do not charge the battery on boats. Remove the battery and charge on shore.
- Never attempt to charge a frozen battery.
- Never attempt to charge a damaged battery.
- Wear protective goggles and turn your face away when connecting or disconnecting the battery.
- Never place the charger on top of a battery.
- Never smoke, use an open flame, or create sparks near battery or charger during normal charging operation as batteries may giveout explosive gas.
- Do not charge batteries in an enclosure (box-in) due to possible explosion of entrapped explosive gas.
- Use of accessory not recommended may cause risk of fire, electric shock.
- Disconnect the mains supply before connecting or disconnecting the links to the battery.
- If the charger does not work properly or if it has been damaged, unplug its AC and DC connection.

#### CAUTIONS

- Refer to battery manufacturer's specific recommended values for battery type settings and float voltage setting.
- Fix the charger to a stable surface using the holes at the flange.
- Ensure all ventilation ports are not obstructed for efficient fan cooling, keep loose soft material or paper off at the bottom of the charger.
- If longer output charging cord is required, make sure the diameter is adequate for the current in given cable length.

## Introduction

Congratulations on purchasing our new 3-Stage (IUoU) switching mode battery charger.

This battery charger is suitable for wet, sealed (RVLA), calcium-calcium, gel and AGM in both car (SLI) and deep cycle type of lead acid battery.

It is a “set and forget” automatic charger which can be permanently connected to battery.

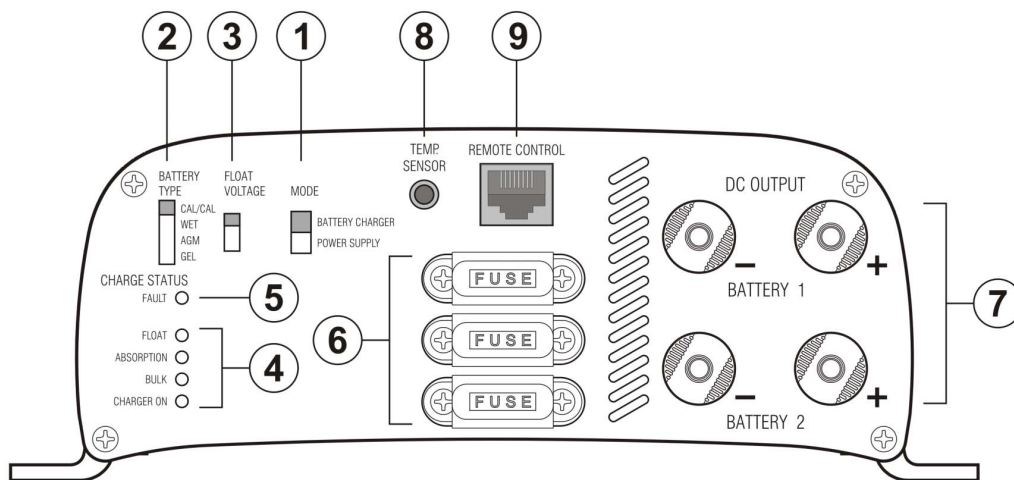
These models have dual charge banks for charging two batteries simultaneously.

The special selectable Power Supply mode allows charging battery with external load.

### **Intended use:**

All automotive, marine, mobile home, electric scooters, golf carts, solar, deep cycle, UPS standby, industrial & commercial applications.

## **A. Control and indicators**



**Fig.1**

### **1. Battery charger / power supply selection**

Slide switch to set charger to 3 stage charger or power supply mode (See section G)

### **2. Battery type selection**

Slide switch to set charger for AGM/gel, wet and calcium-calcium type battery.

### **3. Float voltage selection**

Slide switch to set float charge voltage to 26.4 / 27.0V / 27.6V.

### **4. Charge status LED display**

Charger ON LED	: Green - 3 stage charger mode. // Red - Power supply mode.
BULK LED(Red)	: Bulk charging with constant max. current.
ABSORPTION LED (Orange)	: Absorption charging with preset constant max. voltage.
FLOAT LED (Green)	: Float charging with preset constant voltage.

### **5. FAULT LED (Red)**

Charger malfunction (See trouble shooting)

### **6. Car blade fuse**

Thermal fuse for reverse polarity protection.

### **7. Charging banks**

Screw terminals to connect to supplied charging cable.

### **8. Temperature sensor socket**

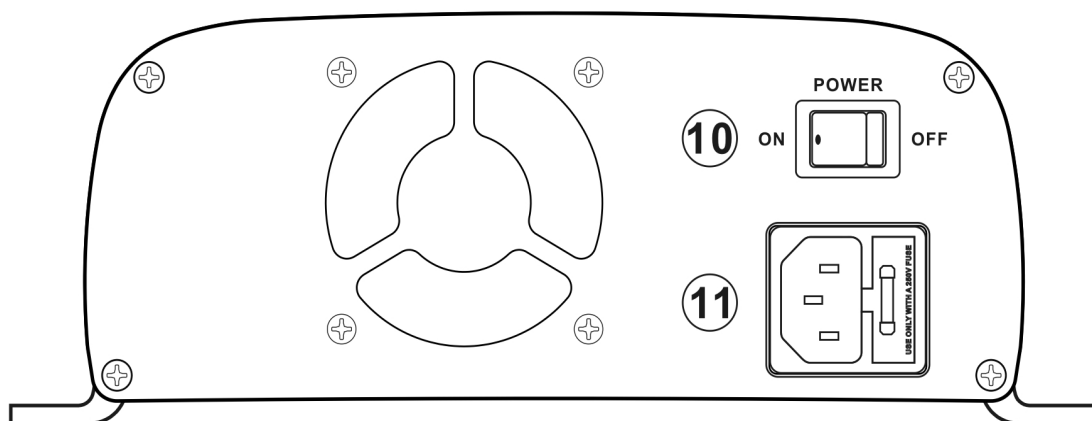
Connection to optional accessory ATS-5120.

Sensor to increase / decrease charge voltage at low / high battery temperature.

### **9. Remote control socket**

Connection to optional accessory ABD-4120.

To remote display the charging voltage & charging status and remote control the charger output ON/OFF.



**Fig.2**

## 10. Power switch

To turn on and off AC power to charger.

## 11. Inlet AC socket with fuse holder

### **B. Battery type selection**

AGM/GEL : Sealed type (VRLA), AGM-GEL, maintenance free, automotive or deep cycle lead acid batteries.

Wet : Flooded type lead acid batteries (to which water can be added) automotive or deep cycle.

Calcium-Calcium : Sealed type (VRLA) lead acid batteries with calcium content automotive or deep cycle.

### **B1. Float voltage selection**

These fine tuned selections of float voltages enable the best voltage level for maximum battery life. Choose 13.8V when in doubt or in power supply mode.

Follow the markings on deep cycle batteries of the standby float voltage.

### **B2. Recommended battery capacity**

The following minimum Ah capacities are a generalized suggestion, some batteries can take higher charge current, check with battery manufacturers for charging batteries with smaller capacity.

Charger model	FUM – 2415CBP, 15A	FUM – 2420CBP, 20A	FUM – 2425CBP, 25A
Battery capacity	50 Ah ~ 150 Ah	70 Ah ~ 200 Ah	80 Ah ~ 250 Ah

### **C. Battery charger installation and connection**

Observe the warnings & safety precautions before rushing to install and operate the charger.

Check battery condition, fill up cells for wet battery, clean battery poles.

Secure the battery charger in a well ventilated place, make sure the mounting surface is flat and without soft covering material or loose paper sheet. The air intake is at the bottom and air outlet at the back. Make sure both intake and outlet are not blocked.

Never place charger on top of battery.

Plug in the AC mains and turn on power switch, the charger ON LED and the float LED should be on green indicating charger is in good order for charging lead acid battery.

Before connecting or disconnecting the charging cable, turn off the power switch and unplug AC cord from the mains. First connect the red cable to positive + terminal of charger and the battery positive + pole. Then connect the black cable to the negative – terminal and the negative – pole of the battery.

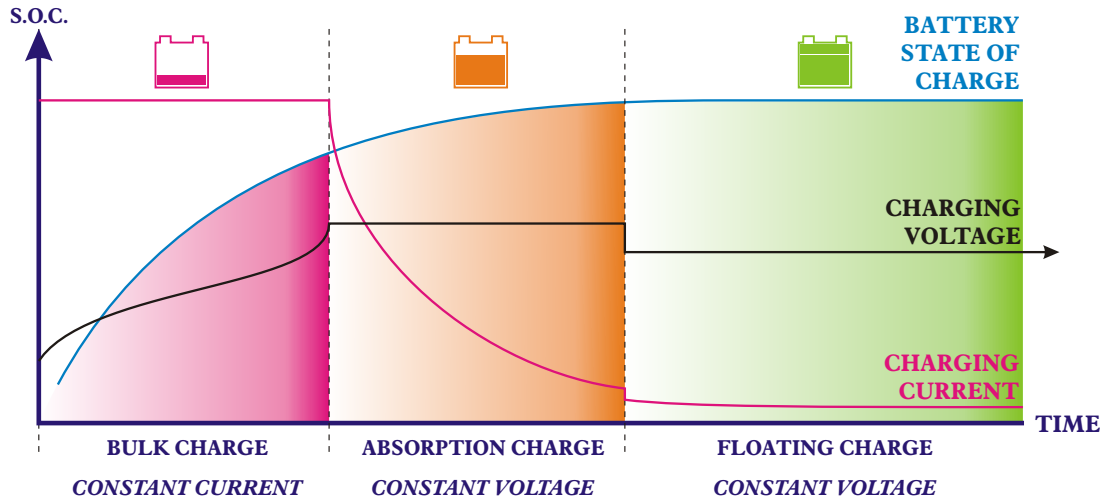
Make sure all the connections are secured and well tighten up, double check on the correct polarity.

Double check again for correct selection of slide switch 1 at charger mode, switch 2 for battery type and switch 3 for float voltage setting value.

## **D. Normal 3 stage (IUoU) charging operation**

The 3 stage IUoU charge algorithm ensures fast, complete and at the same time gentle charging of the lead acid battery.

### **3 - STAGE CHARGING DIAGRAM**



**Fig.2**

**Stage 1. THE I-PHASE.** The constant current charging, bulk LED is on.

Normally the battery is charged at constant maximum current until it rises to the selected absorption voltage level.

The charging voltage changes with the battery voltage.

If the initial battery voltage is less than 18V due to deep discharge, the bulk charge current is reduced to half of the maximum until battery voltage rises over 18V.

**Stage 2. THE Uo-PHASE.** The constant voltage charging, absorption LED is on.

Battery type selection: Gel: 28.2V // AGM: 28.6V // Wet: 28.8V // Calcium: 31.1V

When the battery voltage rises to the selected absorption voltage level, the charging switches to constant voltage charging and battery is over 85% full. The battery is kept at this high voltage while the current reduces gradually to set value at which the charger automatically switches to float stage.

**Stage 3. THE U-PHASE.** The constant voltage charging, float LED is on.

Float voltage selection: 26.4 V // 27.0V // 27.6V

In this stage, the battery is full and only takes in the amount of current necessary for maintaining the capacity. The float voltage is preset independently by user according to the type of battery such that battery can be connected permanently to the charger when it is not in use.

## **E. Manual equalization charging for wet type battery only**

Wet lead acid battery requires periodic high voltage charging (about 10% overcharge absorption voltage) to balance the voltage of each cell, reverse the high concentration of electrolyte at the bottom and clear up large sulfate crystals on the plates. You can use the Calcium-Calcium selection to perform the manual equalization by carefully following the battery maker's recommended frequency and duration.

Make sure to manually switch off charger when time is up.

Take special precautions as battery will emit explosive gas during equalization charge.

## **F. Dual bank charging**

This feature is for caravans, and vehicles with two separate batteries.

The two batteries must be of same chemical make up and type to avoid over and under charging because only one setting of charging profile for both.

Two batteries are charged simultaneously and the battery with the lowest level gets most share of the current in the bulk charge stage until it is up to the same voltage level of the second battery (battery with higher initial level).

Both batteries will go to the absorption and the float charge at the same time.

## G. Power supply / 2 stage charger mode (see Fig.3)

At this mode the Charger On (5) LED becomes red color and only bulk and float LED will function. The bulk LED will be off when battery is charged to about 80% full.

The 3 stage charger becomes a 2 stage charger or as power supply in this selected mode because 3 stage charger overcharges battery with external load.

This selected mode is intended for use to charge battery with external load such as caravan or other battery and external load combination.

A 2-stage charger can be used as a combination charger/power supply. An external load can draw current from the charger while the charger is recharging a battery. The charger doesn't care how much current is being diverted by an external circuit as it switches from bulk mode (constant current) to float mode based only on the battery terminal voltage.

However, a 2-stage charger cannot completely charge the battery when the charger switches from bulk mode to float mode. After switching to float mode, the battery will, in most cases, be about 80% recharged. The battery receives the remaining recharge while in float mode over several days.

It is highly recommended to switch back to the 3 stage charger mode periodically when the external load is disconnected.

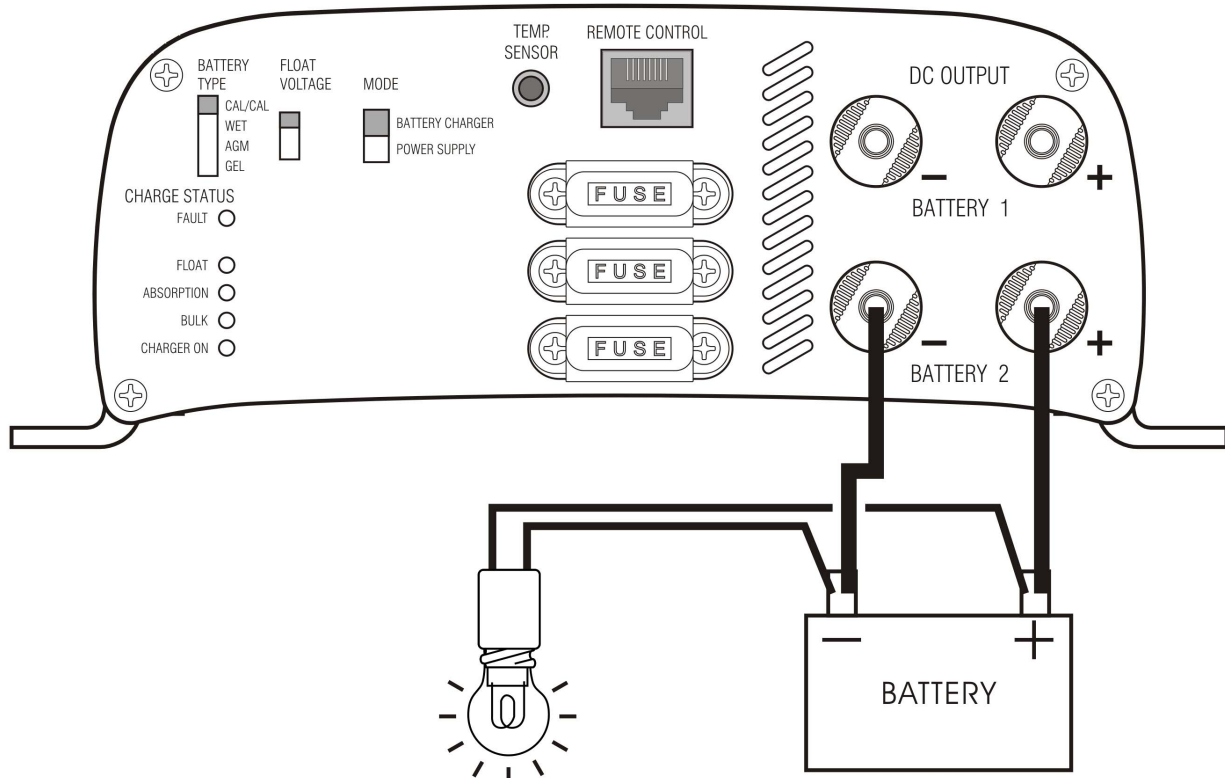
Also the external load should not be more than 50% of the max. current of the charger, unless the battery is fully charged up. If the bulk LED is on most of the time then the load is too large.

### G1. As a stand alone power supply

It can also be used as a stand alone power supply without connection to a battery. It will provide a constant voltage according to the selected float voltage (26.4/27.0/27.6V) and rated DC current of the charger.

However, it is not recommended for high surge load (such as lamp) in stand alone application as the initial high surge current will trigger the overload protection of the power supply.

### Power supply / 2 stage charger mode application



## H. Temperature sensor

### Warning:

*The temperature sensor must be installed at the negative terminal of the battery terminals, wrong connection to the positive terminal will damage the charger and the sensor.*

The temperature sensor is available as an optional accessory (ATS-5120) and is used to optimal charging over wide ambient temperature range.

Fix the temperature sensor (optional accessory) in a position on the battery which is not affected by other cooling or heating source.

Plug in the temperature sensor before switch on the charger to activate the temperature control function, never plug in the charger during charging.

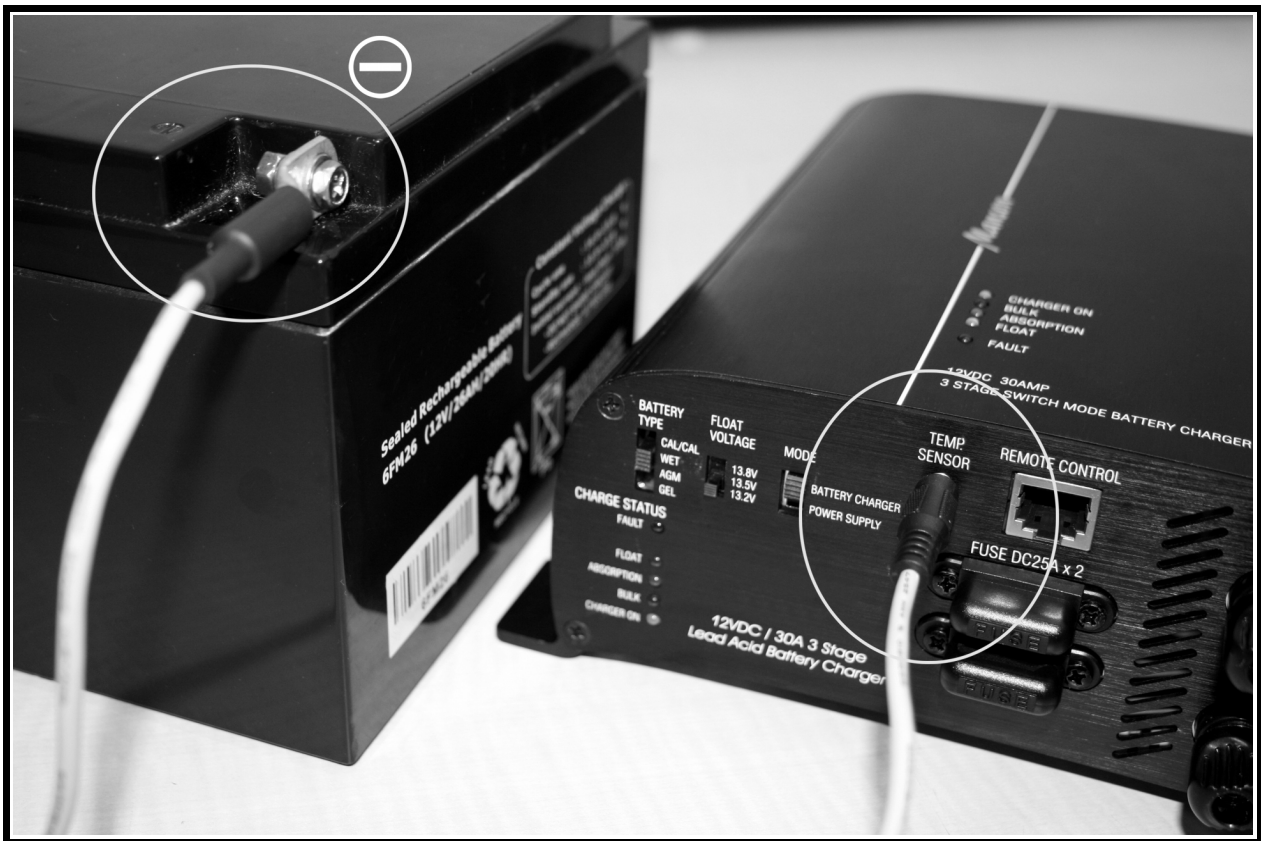


Fig.5

## I. Cable size selection

Wire size (AWG)	Area (mm <sup>2</sup> )	Maximum one-way distance for 2% voltage loss (24V 15A)	Maximum one-way distance for 2% voltage loss (24V 20A)	Maximum one-way distance for 2% voltage loss (24V 25A)
10	5.26	4.65 m – 15.3 feet	3.50 m – 11.5 feet	2.80 m – 9.2 feet
8	8.37	7.31 m – 24 feet	5.48 m – 18 feet	4.39 m – 14.4 feet
6	13.3	11.58 m – 38 feet	8.84 m – 29 feet	7.01 m – 23 feet
4	21.2	18.29 m – 60 feet	13.71 m – 45 feet	10.97 m – 36 feet
2	33.6	29.26 m – 96 feet	21.94 m – 72 feet	17.68 m – 58 feet
1/0	53.5	46.94 m – 154 feet	35.35 m – 116 feet	28.04 m – 92 feet
2/0	67.4	58.52 m – 192 feet	43.89 m – 144 feet	35.05 m – 115 feet
4/0	107	85.95 m – 282 feet	64.62 m – 212 feet	51.51 m – 169 feet

Table: Selection of cable size and length versus current.

## J. Trouble shooting

PROBLEM	INDICATIONS	POSSIBLE CAUSES	SUGGESTED SOLUTION
Charger does not work.	Indicator lights not turn on.	No AC power.	Check AC connections are correct.
		AC input socket fuse blown.	Replace with correct AC fuse by qualified electrician.
No DC output.	Charger ON LED is not on, float and fault LEDs are ON.	Output short circuit.	Check DC connections between charger and battery.
		Over temperature protection triggered.	Check air intake vent at bottom of charger is blocked or not. Check charger ambient ventilation.
		Severe over loading charger.	Check battery Ah capacity within recommended range.
		Reverse polarity connection.	Check for correct polarity, replace car blade fuse (7).
Battery does not get full charge.	All indicator LED work normally and sequentially.	Bad battery connection.	Check for loose contact, right cable size, cable integrity.
		Battery type select switch in wrong setting.	Recheck battery type and change to correct battery selection.
		Battery capacity too large.	Make sure charger rating matches battery capacity. See table (B2).
		Ambient temperature too low.	Move battery to a room temperature location, or get an optional temperature sensor.
		Battery has damaged cell or battery is too old.	Replace battery.
Long charging time, float light does not come on even after 20 hours charging time.	Absorption light remains on all the time.	Wrong battery type selection eg. charge gel battery with Calcium-Calcium or wet type selection.	Check charged battery label and change battery type selection to correct setting.
		Total battery capacity is too high for dual charging.	Check battery capacity or charge battery separately.
		Battery temperature too high.	Use temperature sensor (optional accessory).
		Battery is defective.	Replace battery.
		A load is connected to battery and charger is not in power supply mode.	Change charger selector switch (2) to power supply mode.
Bulk LED is on all the time.	Bulk light remains on all the time when charger is in power supply mode, LED(2) is on red.	The connected load is too large, using most of the current from the charger.	Reduce the load to about 50% of the charger's rating current or take away the load and set charger to battery charger mode to fully charge the battery before return back to the power supply setting and load connection.
	Bulk light remains on all the time when charger is in battery charger mode, LED(2) is on green.	Wrong battery type selection.	Check charged battery label and change battery type selection to correct setting.
		Battery is excessively depleted and the soft charging is triggered.	Recharge the battery after a day, if bulk light remains after several hours, the battery is most likely damaged and cannot accept charge. Replace battery.
		Battery temperature too high.	Use optional accessory temperature sensor.

## K. Specifications

Model		FUM – 2410CBP	FUM – 2415CBP	FUM – 2420CBP
Output	Absorption charge voltage selections	Gel: 28.2V / AGM: 28.6V / Wet: 28.8V / Calcium-Calcium: 31.1V		
	Absorption charge timer	Limited not over 4 hours.		
	Float charge voltage selections	26.4V    27.0V    27.6V		
	Battery charger / power supply selections	Yes		
	Maximum output charging current (continuous)	15A	20A	25A
	Recommended battery capacity range	50~150 Ah	70~200 Ah	80~250 Ah
	Soft start bulk charge			
	Battery voltage to trigger (cut-in) soft start bulk charge mode	< 18V		
	Soft start bulk charge current (current limit)	7.5A	10A	10A
	Line regulation (90~260V) for charging current	< 0.5%		
	Ripple and noise (peak to peak)	< 250mV	< 250mV	< 250mV
	Efficiency at maximum power (100/230VAC)	> 86/90%	> 86/90%	> 86/90%
	Dual bank charging (battery must be of same type)	Yes		
Input	AC voltage range	100~260 VAC 50Hz		
	AC current at full load (100/230VAC)	5.6/2.4A	7.4/3.2A	9.3/3.9A
Protection	Overload	90~110% rated output current or 50% rated output current (soft charge). Protection type: constant current limiting, recovers automatically after fault condition is removed.		
	Short circuit	Recovers automatically after fault condition is removed.		
	Reverse polarity	Car blade fuse.		
	Over temperature	Protection type: shut down.		
	OVP output over voltage	Yes		
Cooling	Cooling method	Thermostatic, Variable speed fan.		
Indicators	3 stage battery charger / power supply mode	Yes		
	Charge phase bulk / absorption / float	Yes		
	Fault mode	Yes		
	AC power	Yes		
Fuses	AC fuses at IEC AC power socket	T6.3A	T8A	T10A
	DC car blade fuse at front panel	25A x 1	15A x 2	20A x 2
Accessories	Cable & spare fuses	Yes		
	Remote temperature sensor	Optional		
Approvals	Safety: EN 60335	Yes		
	EMC: EN 55014	Yes		
Others	Dimensions and weight	220 x 80 x 200mm; 2.4Kg	220 x 80 x 250mm; 2.8Kg	220 x 80 x 261mm; 3.2Kg
Remarks	All values are based on the standard ambient temperature 25°C and pressure 0.1Mpa			